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Health and working conditions among low-educated women

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List of papers

This thesis is based on the following papers, which will be referred to by their Roman numerals

I. Dahlberg R, Bildt C, Vingård E, Karlqvist L

Educational background – Different processes and consequences on health and exposures among women and men. Submitted.

II. Dahlberg R, Karlqvist L, Bildt C, Nykvist K

Do work technique and musculoskeletal symptoms differ between men and women performing the same type of work tasks? *Applied Ergonomics*, 2004; 35 (6): 521-529

III. Dahlberg R, Bildt C, Karlqvist L.

From Canteen to Lunch Box: Ergonomic Demands in Distribution of Portion-Packed Hot Food. *Women & Health*, 2003; 37 (2): 31-53

IV. Dahlberg R, Vingård E, Karlqvist L

Factors associated with self-rated good health in low-educated, gainfully employed, older women. Submitted.

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Introduction

Why study health and working conditions in low-educated women?

In Sweden, the group most exposed to illness, long-term sick leave and early retirement in the labour market is low-educated women. In the age group 45-64, long-term sick leave is about three times more common among female blue-collar workers than among male white-collar workers (LO 2004). Women's educational levels, which are correlated to working conditions, are also of importance in this respect. The risk of early retirement and long-term sick leave is higher among low-educated women compared with high-educated women (RFV 2003, 2004).

The basis of this thesis is to gain a deeper understanding of these unequal circumstances in health among low-educated women compared with other groups.

Gender perspective

A gender perspective is necessary in research concerning health and working conditions, since Sweden has a gender-segregated workforce which leads to men and women working in different occupations (Gonäs & Spånt 1997, Siltanen et al 1995, Westberg 1998). Working conditions and workload differ significantly between the sexes and the consequences on health are also different.

In gender research the two concepts "sex" and "gender" have different meanings. While "sex" refers to the biological differences between men and women (such as muscle mass, hormones, height) the term "gender" is used to separate biological sex from the social, cultural and historical construction of femininities and masculinities (Rubin 1975). Gender was introduced in order to emphasise that the differences between men and women are not constant. Gender means how biological sex is interpreted in different cultures. The social construction of gender is a continuously ongoing process.

Biological and social factors should be analysed at the same time; what is considered biological may also be socially determined and vice versa. According to Robert Connell the relationships between men and women can be seen as part of a larger pattern of gender relationships in all sectors of society, the so-called gender order in which male domination is created and maintained (Connell 1987). The gender order in society is the basis for its gendered division of labour, resources and control. In the labour market, occupations become gendered as they are characterised by qualities, attributes and behaviours assigned to men and women. The horizontal segregation of the labour market means that men mainly work in male-dominated sectors, while women work in the female-dominated sectors (Lagerlöf 1993, Westberg 1998). Men are found to a greater extent in the higher positions and women in lower positions in both male- and female-dominated occupations. In fact, there are systematic differences between genders in the same occupation in terms of grade, pay, authority and career opportunities (Östlin

2002, Statistics Sweden 1997). Another structure in society is characterised by the gendered division of power expressed in decision-making, authority and control. This vertical segregation means that men are over-represented at the highest levels with regard to status, power and income. As a consequence women have lower wages than men do, even if they do the same job and have the same level of education (Statistics Sweden 1998).

The problematisation of the male norm in public health research has led to new research questions about women's health. For example, what does it mean for women with neck and shoulder pain that many workplaces are constructed using a male body and capacity as the norm? Are the results from the research on men also valid for women?

Gender research is a multidisciplinary and critical analysing perspective that puts gender in the centre of the analysis, regardless of the research question.

The concept of health

The concept of health is complex. The earlier definition of health by the World Health Organization (WHO) was: “a state of complete physical mental and social well-being, not merely the absence of disease or infirmity”(WHO 1948). This definition from 1948 has been criticised for its broadness and for the problem in measuring “complete well-being”. It does, however, take into account that there is significant variation in how health is perceived. The WHO definition of health has later been developed into a continuous process and a resource more than a goal in itself (WHO 1986).

In a literature review of the concept of health, Medin and Alexanderson found two clear directions in health theories: the biomedical and the humanistic. Within the biomedical direction, a mechanistic and a biostatic approach were found. Briefly summarised, mechanistic health theory implies that health exists when all body parts function in a “normal way”. In the biostatic theory, health is defined as absence of disease. According to the authors, the humanistic health theories can be divided into seven approaches: holistic, psychosomatic, ecological, behaviourist, homeostatic, teleological and a salutogenic. What all these approaches have in common is that health is considered something more than the absence of disease. Humans are seen as having an active and creative nature, and being a part of the interplay between individuals and the context in which they function (Medin & Alexanderson 2000).

Medin and Alexanderson have also described four main features in the way we look at health: as a condition, a perception, a resource and a process (Medin & Alexanderson 2000).

1. Health as a condition is a view where health and disease are seen as anti-theses on a continuum. The health of the individual is better or worse, dependent on where on the continuum he/she is. Through interventions the condition of health can be better or worse. Even within the biomedical direction health can be viewed as a condition. You can either be healthy or sick.

2. Health as a perception is found within the teleological and the salutogenic approaches. The perception of health is synonymous to perceiving e.g. well-being or meaning of life.

3. Health as a resource can be viewed as one resource among other resources (e.g. education, work) that are important for the individual to achieve goals in life.

4. Health as a process means that health is not a static condition. It is something that can always be changed and influenced.

Difficulties in finding good measurements of health have led to different estimation methods. Measurements can be based e.g. on medical assessments of functional ability by a physician, the individual's perception of his/her health or society's assessment of health (e.g. when social insurance compensates loss of income during absence from work due to illness). These three measurements sometimes, but not always, agree.

One rather common way of measuring perceived health is by asking the single question: "How do you rate your health in general?" This single question has been shown to have good test-retest reliability, and correlates strongly with other direct or indirect measures of health (Mackenbach et al 1994, Streiner & Norman 1989, Idler & Benyamini 1997).

Socio-economic differences in health

Differences in morbidity (illness, disease and sickness) and mortality due to socio-economic status have been reported in several studies for both women and men. Inequalities in self-reported morbidity are substantial everywhere and nearly always in the same direction: persons with lower socio-economic status have higher morbidity rates (Kunst et al 1995, Lahelma & Arber 1994, Mackenbach et al 1997, Borg & Kristensen 2000, Kunst et al 2000).

However, the general observations are that socio-economic inequalities in health are more obvious among men than among women (Matthews et al 1999). A study by Stronks and colleagues found that inequalities in perceived general health were clearly evident among men, but there were hardly any differences among women (Stronks et al 1995). Furthermore, the choice of indicator used to measure socio-economic position appears to have a great relevance. For instance, when studying rates of self-perceived health, educational background showed a sharper gradient than occupational class gradients in various self-reported measures for men, but not for women.

It is unclear whether socio-economic inequalities in self-reported morbidity are increasing, remaining stable or decreasing. Some studies have reported increasing inequalities, but a recent comparative overview of the situation in six Western European countries has shown that the picture is far from clear. The direction and magnitude of the changes seem to vary by country, socio-economic indicator and type of health problem (Cavelaars et al 1998).

Gender differences in health

One way of explaining differences in health outcomes between men and women has been presented by Hammarström et al. In a literature review they found two main types of models explaining differences in health between men and women (Hammarström et al 2001):

a: The biological/genetic model, which emphasises sex differences in biological structure in terms of genes, hormones and physiology, factors that lead to different risks of illness.

b: The socio-cultural model, which focuses on gender differences in health-related behaviour, as well as on life circumstances such as work, family and other socially determined factors that may pose a risk to health.

Hammarström et al argue that research focusing only on either socio-cultural factors or biological factors cannot adequately explain sex or gender differences in health between women and men (Hammarström et al 2001). Socio-cultural factors, such as work environment and lifestyle, affect factors that are clearly biological in nature, such as stress hormones, muscle mass and the immune system. Research on biological factors can explain and describe biological and physiological differences between women and men, but cannot answer questions such as why women live longer than men, when they are less healthy than men.

In Sweden, as well as in other countries, researchers have turned their attention to what is sometimes termed the “gender paradox” or “health paradox”. While illness often precedes death, women live longer than men despite being sicker than men. A corresponding discrepancy is not found for class differences in health. In lower social classes, both women and men have higher mortality and higher illness rates than more advantaged individuals (Danielsson & Lindberg 2001).

Studies from mainly industrialised countries show that men more often than women are exposed to noise, vibrations, unfavourable climate conditions, and other types of traditional physical and chemical risks. Consequently, solvent-related illnesses, hearing loss and vibration injuries are more common in men than in women. Moreover, almost only men are killed in work accidents, as those accidents mainly occur in male-dominated occupations (Kjellberg 1998).

On the other hand, women are generally exposed to psychosocial risk factors at work more often than men. Such a factor is negative stress, which has been defined as a combination of high mental demands and low decision latitude (Karasek & Theorell 1990). Furthermore, women are more often exposed to repetitive movements and monotonous work than men. Consequently, mental health problems and fatigue, repetitive strain injuries and musculoskeletal disorders (MSDs) are more common in women than in men (Östlin 2002, Kauppinen & Kandolin 1998).

The greatest differences between women and men in health outcomes have been shown regarding musculoskeletal symptoms (Punnet & Herbert 2000).

Differences in musculoskeletal symptoms

The human body is created for moving. To maintain the functions of the body, a mixture of moving, physical load and recreation is needed. A favourable physical load is characterised by recurrent variation, balance between activity and recreation and is also limited in time. A favourable load could be different for different individuals, depending on the individual's conditions and sensitivity. The conditions vary with physical and psychological capacity, with body size, sex, age, experience, aerobic capacity, motivation and impairments, if any. The initial position in, for example, work environment legislation is that a balance between work demands and human conditions should be created in that work should be adapted to the human being (AFS 1998). A tiring physical load is not necessarily dangerous in a short perspective but could lead to serious consequences in the long run. For many types of load there is well-established knowledge about associations between load and the risk of developing work-related disorders (Bernard 1997, Hagberg et al 1995, Nygård et al 1994, Punnet & Bergqvist 1997).

Musculoskeletal disorders (MSDs) are the most common cause of sickness absence and disability pension in Scandinavia, as well as in most other Western countries (Alexanderson & Östlin 2001, Nachemson & Jonsson 2000). Musculoskeletal disorders are more common among women than among men. This is a well-known fact that has often been discussed in literature and supported by a large number of studies, especially with regard to neck and shoulder disorders (Kilbom & Messing 1998, Punnet & Herbert 2000, de Zwart et al 2001). Comparisons of the prevalence of MSDs between men and women are difficult to make, as men and women seldom perform the same type of work tasks, and are therefore not exposed to the same risks. Additionally, although men and women may have the same job title, they still do not perform the same type of work tasks (de Zwart et al 2001, Messing et al 1994, Härenstam et al 2003).

Heavy lifting, awkward postures and monotonous and repetitive work tasks are known as risk factors for developing MSDs (Bernard 1997, Hagberg et al 1995). Technical development, in terms of reducing physical workload, has mainly favoured men in typically male jobs, e.g. in the manufacturing industry (Punnet & Herbert 2000). At the same time, not much has been done to reduce workload in typically female jobs, e.g. in the service and health care sectors. Today women are probably more often exposed to monotonous, repetitive and heavy work tasks than men, e.g. health care personnel, cashiers and cleaners (Kilbom & Messing 1998, Silverstein et al 1986).

Biological differences, such as muscle strength and body size, are often mentioned to explain differences in MSDs between men and women, but few studies have actually been carried out in this field (Kilbom & Messing 1998). Miller et al (1993) have shown that gender differences in muscle strength are mainly noted in muscles in the upper extremities, especially the shoulders. Other studies have shown that women's lower muscle strength can be compensated to some extent by longer muscle endurance (Clarke 1986, Jørgensen 1997). Pheasant (1996) has shown that the average woman is about the same height as the shortest

5 per cent of men, and that the average man is about the same height as the top 5 per cent of women. On the other hand, Kilbom and Messing (1998) have shown that biological differences are greater between individuals, among both women and men, than between the sexes.

The higher prevalence of MSDs in women compared with men may also depend on the design of workplaces and hand tools, which is often based on anthropometrics data for men (Pheasant 1996). Ducharme (1973) showed that women were disadvantaged and experienced more discomfort when using hand tools designed for men. Karlqvist (1997) showed that in computer mouse work using a common keyboard, the wrist and arm postures were more awkward for women than for men, probably because the width across the shoulders is narrower in women than in men.

Non-occupational factors that might affect the gender-specific relationship between occupational exposures and MSDs include time spent on household work, roles at home and recreation activities. Gender differences in time spent on unpaid work at home have been reduced in Sweden (Nermo 1994), but men still spend less time than women on unpaid work, and women still have the main responsibility for home and family. Moreover, gender differences seem to increase with the number of children in the family (Lundberg et al 1994). Härenstam et al (2003) have shown that women on average spent nearly twice as much time on unpaid work per week as men did.

The segregated labour market

Gender-segregated labour, which can be observed worldwide, both in the domestic and the occupational domain, plays a significant role in determining women's and men's social status in society and explains their differential exposures at work to health-promoting and health-damaging factors (Östlin 2002).

The labour market in developed countries has undergone considerable changes over the last decade. The emergence of flexible production processes and flexible work organisations has had a significant impact on people's professional lives. Today many workers are meeting the demands of the new economy. Although there has been a general improvement in the work environment during the same period, many workers experience adverse working conditions, stress and ill health.

Most employed women in Sweden are found in the public sector, e.g. in the health care, social and education services, and in a relatively limited number of occupations. Employed men are more often found in the private sector, e.g. in the manufacturing, technical and information technology industries, and in a larger number of occupations than women. As a result, women and men are not exposed to the same risks at work, or if they are, the extent of exposure may vary significantly (Östlin 2002).

Today's working life is not to any great extent characterised, as it was earlier, by many physically heavy loads; and although many heavy work tasks are now mechanised such tasks still exist in different occupations and the work capacity of the individual is still of importance. As physical capacity decreases with increased

age, workload is perceived differently by younger and older employees (Åstrand 1990). Muscle capacity declines with age, but at somewhat different rates for different occupational groups, as well as for different muscle groups. While strength in the upper extremities remains relatively unchanged until the age of 50, there is usually a decline in leg muscle strength in earlier age, probably due to lack of training (Larsson et al 1979). Working conditions with great opportunities for the employees to decide how and at what pace the work tasks are to be performed make it possible for older employees to handle the work.

It has been shown that women's and men's career opportunities, and therefore their opportunities to reduce the physical load in their work, are diverging. A Stockholm-based study showed that women to a higher degree than men stayed at a level where the physical load in work during a 25-year period remains. Men's physical load was initially higher but decreased as they got older. The same tendency was not seen among women. One explanation was that the really heavy work tasks had been mechanised, and since men have traditionally performed these work tasks it is men that have "gained" most as a result of technical developments. Another explanation is that women more often than men stay in monotonous and repetitive work situations, while men more often make a career within the company and reduce their physical load by working as supervisors, or alternatively by changing their workplace, and thereby reducing their workload. (Torgén 2002, Kilbom & Messing 1998).

Physiological differences between men and women, such as muscle force and length, have sometimes been put forward as strong reasons to support the idea that women are suitable for certain work tasks and men for others. This may account for the high prevalence of musculoskeletal disorders among women. A question raised about design of tools, e.g. hand tools, is that they are designed to fit an average man, which means that they not only do not fit most women, but they do not even fit the shortest/smallest men (Hall 1995). The same situation is also seen regarding workplaces where the man's average height and breadth are still the norm (Karlqvist et al 1999). Women's lesser muscle mass is in one way compensated by better endurance. This indicates cultural norms and sex stereotyping guide the choice of occupation for men and women.

Although there have been some numerical changes over the past couple of decades in occupational gender segregation in Sweden, the overall picture has remained very much the same (Tyrkkö & Westberg 2001).

The segregated domestic market

There are also great differences regarding other life circumstances. Women perform most of the domestic duties, and a great deal of the total load is related to tasks in the household. This is especially obvious for low-educated women who to a greater extent than other women take the responsibility for household duties. It is important to take into consideration the whole life situation when the complex association between health and life circumstances is examined (Härenstam et al 1999).

The division of domestic work by gender is an important predictor of the overall level of gender inequality (Chafetz 1984). When women take the main responsibility for domestic duties and childcare, they risk many disadvantages in waged employment (Nermo 1999).

Gender division of work is as obvious within the household as in the labour market. In most countries, this means that women have the main responsibility for looking after the children and taking care of daily household tasks, such as cooking and cleaning. Men are usually responsible for car maintenance and house repairs. One important characteristic of women's work in the household is that much of it cannot be postponed, and as a result, women's leisure time is more fragmented than that of men (Frankenhaeuser et al 1991, Bird & Hill 1992).

Aims in this thesis

Overall aim

The overall aim was to gain a deeper understanding of low-educated women's conditions at work and in the domestic sphere, and how this affects their health.

Specific aims

Study I. To study differences in health and exposures between women and men with the same educational background. A second aim was to estimate the risk of adverse health effects associated with the level of education of women and men.

Study II. To compare work technique and self-reported musculoskeletal symptoms between men and women performing the same type of work tasks.

Study III. To examine the physical and psychosocial working conditions among a group of female hot food distributors, and to relate these conditions to other traditionally heavy work within the same work unit, as well as to suggest improvements.

Study IV. To look for factors that are associated with self-rated good health outside the paid work in low-educated, gainfully employed, older women.

Subjects

In all four studies the subjects were individuals from three municipalities in the county of Östergötland in the middle part of Sweden. Low-educated women were represented in all studies, but men and women with higher education have also participated in some of the studies (Table 1). All women who participated in studies II, III and IV have been designated as low-educated as they have job titles that are usually defined as blue-collar occupations, which are often associated with a low level of education.

Table 1. Subjects participating in the studies.

	Sex	Number	Age (Yr)	Working sector	
			mean (range)	Public %	Private %
Study I					
<i>Educational background</i>					
9-year compulsory school	Women	365	45 (18-62)	51	43
	Men	371	46 (18-62)	20	75
3-year upper secondary school, i.e. in total 12 years of education	Women	1161	40 (19-62)	60	36
	Men	1047	39 (19-62)	25	71
Post-secondary school, such as university and university college	Women	539	44 (23-62)	83	15
	Men	348	45 (22-62)	58	40
Study II					
Industrial workers	Women	23	39 (23-60)		100
Industrial workers	Men	32	33 (20-54)		100
Study III					
Cleaners	Women	2	41 (38-41)	100	
Cooks	Women	3	43 (35-53)	100	
Food distributors	Women	5	38 (26-53)	100	
Study IV					
Assistant nurses, nursing aides, home care workers and personal assistants.	Women	140	53 (45-64)	100	

Study I

The subjects of this study were those who answered a questionnaire survey that was performed by the National Institute for Working Life in 2001. The questionnaire was randomly distributed to 7057 gainfully employed persons living in one region in Sweden that was presumed to be representative for the whole country. In all, 3891 persons (55 %) responded after two reminders. A non-response analysis showed that more older than younger people, more women than men, more high- than low-educated, and more ethnic Swedes than immigrants responded.

Based on register data from Statistics Sweden, respondents were grouped into three educational categories (Table 1): Category 1, which represents 9-year compulsory school; Category 2, which includes 3-year upper secondary school

(i.e. a total of 12 years of education; and Category 3, which refers to post-secondary school (including university and college). Data on education were missing for 60 persons, who were thereby excluded from the analyses, and the study group then consisted of 3831 persons. More women than men in each education category were working in the public sector.

Study II

This study population consisted of 61 blue-collar workers who worked in the same department in a metal industry in one of the studied municipalities. They were given a questionnaire and, after one reminder, 55 (90 %) responded. These 55 workers, 32 men and 23 women, formed the study group.

Study III

The study group consisted of 10 females. Five of the females worked as food distributors, two as cleaners and three as cooks. The food distributors were matched according to age and sex with the comparison groups, i.e. the cleaners and the cooks.

Study IV

The study group consisted of 140 females aged 45-65. They were all employed by the municipality in the department of social care and worked as assistant nurses, nursing aides, home care workers and personal assistants. The study group had answered a self-administered questionnaire, and aerobic capacity had been measured.

Ethical approval

All of the studies were approved by the Ethics Committee at Linköping University. All subjects were given written and/or oral information about the studies and gave their consent to participate.

Methods

Study designs

All studies except study III had a cross-sectional design. Study III was an intervention study with a follow-up.

Studies II and III were performed as case studies at the ordinary workplaces of the study persons. Study I was an epidemiological study based on a population-based questionnaire. Study IV used a combination of questionnaire data from a municipality health project and exploratory interviews.

Data collection methods

The data collecting methods used in the studies were self-reported questionnaire, interviews, observations and direct measurements (Table 2).

Table 2. Data collection methods used in the four studies. Numbers of subjects are indicated.

Data collection methods	Study I n=3831	Study II n=55	Study III n=10	Study IV n=140
Self-administrated questionnaire	3,831	55		140
Interviews		32	10	20
Systematic observations		12	3	
Heart rate measurements			8	
Perceived physical exertion (Borg-scale)			8	
Cycle ergometer sub-maximal tests				118

Study I

In study I, a questionnaire was used. Questions on health status included general health, mental health, psychosomatic symptoms and musculoskeletal symptoms.

The questionnaire also included a wide range of questions on exposure to physical and psychosocial risk factors at work, including questions on work organisation, unpaid work at home and leisure, and lifestyle. All questions in the questionnaire have been validated in earlier studies.

- One question about *general health* was derived from the SF36 questionnaire (Brazier et al 1992): “How would you rate your health in general now?” There were five response alternatives: excellent, very good, good, fair, poor.
- Questions about *mental health* were derived from the GHQ12 questionnaire (Goldberg & Williams 1998).

- The three questions about *psychosomatic symptoms* were: “Have you during the last 3 months suffered from (1) fatigue, (2) headaches, or (3) sleeping problems?” There were three response alternatives: Yes, often (every week), Yes, sometimes, No, never.
- Questions about musculoskeletal symptoms were derived from the Nordic Questionnaire (Kuorinka et al 1987).

Questions on *physical work exposure* were focused on known risk factors for developing musculoskeletal symptoms, such as manual material handling, working with hands above shoulder height, repetitive work tasks, etc (Bernard 1997, Hagberg et al 1995).

Questions on psychosocial work exposure, such as support from colleagues and control at work, the demand/control model, were derived from Karasek and Theorell (Karasek & Theorell 1990).

Questions on *work organisation* included negative changes in working conditions during the last 12 months, negative expectation of the future and work flexibility (Härenstam et al 1999).

Questions on *unpaid work at home and leisure* included how much time the respondents spent on household work during a normal working or non-working day, including childcare and house repairs/maintenance; how much time the respondents spent on sedentary leisure activities, such as watching TV, reading and social life; and how much time they had on their own (Härenstam et al 1999). Perceived physical exertion in unpaid work was rated on a Borg scale (Borg 1970).

Questions on *lifestyle* included smoking and exercise habits. Respondents were also asked to fill in their weight and height for the calculation of body mass index (BMI) (Härenstam et al 1999).

Study II

In this study three data collection methods were used: Questionnaire, Interviews and Systematic observations.

Questionnaire: A self-administered questionnaire was used, including questions of demography and self-reported musculoskeletal symptoms. The Nordic Questionnaire was used to measure musculoskeletal symptoms (Kuorinka et al 1987).

Interviews: Structured interviews were carried out with 14 men and 18 women. The interviews took place during working hours and lasted about one hour per person. The sample was randomised among those who had answered the questionnaire.

Time spent on various leisure activities was measured by an activity-oriented interview method (Wiktorin et al 1999). Leisure time was defined as 24 hours minus working hours minus 8 hours for sleep, and covered 6 predetermined areas of activities.

Observations: Systematic observations were carried out with six men and six women according to the following criteria: both the men and the women should differ in height and they should have no objection to being observed. Each person was videotaped twice at different times of the work shift (in assembling or dis-assembling and packing work). To get an estimation of work tasks and postures over a whole work shift, two work cycles were videotaped, including what was happening between the work cycles. Observation times were randomly selected over the work shifts and varied from 9 to 39 minutes ($m = 24$ minutes), depending on length of work cycles.

Study III

In study III both qualitative and quantitative data collection methods were used to examine the working conditions of the food distributors and the comparison groups. The same methods were used at base line and at the follow-up.

Structured interviews regarding the psychosocial work environment and the staff's own ideas and suggestions for improvements were carried out with five food distributors, three cooks and two cleaners.

Heart rate and perceived physical exertion were used to measure physical load.

Ratings of perceived exertion based on the Borg scale (14-grade scale from 6-20, verbally expressed from very, very low to very, very high) (Borg 1970), were carried out for four food distributors, two cooks and two cleaners. Each person did this three times: in the morning, in the middle of the day and in the afternoon.

Heart rate measurements were carried out during a whole work shift, including breaks. Owing to the different working hours, the measurements were carried out for about 5-7 hours. Heart rate was measured with two heart rate meters, Sport Tester PE3000 and Polar Vantage XL (Polar Electro). The meters have shown very good validity when correlated to heart rates measured by electrocardiographic recordings (Leger & Thivierge 1988, Laukkanen & Virtanen 1988, Godsen et al 1991). Their transmitting unit consists of an electrode belt fastened around the chest, and a storage unit fastened around the wrist like a wristwatch. The heart rate was recorded continuously and stored as average rates once every minute. After each measurement, the stored data were transmitted via an interface to a computer and analysed with an appropriate computer program.

The observations were carried out with one randomised person from each respective staff category for a whole work shift. During the observations, notes were taken minute by minute during the whole observation time. They covered type of activity (e.g. cleaners mopping floors and cleaning toilets, cooks preparing food and cooking, and food distributors portioning and delivering lunch boxes) and type and duration of working posture (sitting, standing or walking posture).

Study IV

Study IV was conducted in two steps. The first step was to conduct exploratory interviews in order to define factors that might be associated with self-rated good health. The second step was to test these factors against the results from a

questionnaire and measurements of aerobic capacity, and compare the results between the “healthy group” and “the others”.

Twenty females from the “healthy group” were randomly selected to be interviewed. Before the randomisation was carried out, all those who had had any long periods (over 28 days) of sick leave during the last two years or recurrent short sick leave (more than 5 times during the last year) were dismissed.

Interviews: The length of the interviews varied from 50 minutes to 1 hour and 15 minutes. Informed consent to audiotape the interviews and to use the information for research purposes was obtained. The focus of the interviews was on listening to the person’s own story and exploring what the respondent considered to be important factors to keep in good health. The initial question was: “In your opinion, what are the most important factors for why you perceive your health as good?” Semi-structured questions were also asked regarding leisure interests and lifestyle.

Questionnaire: A self-administered questionnaire was used. Questions about different possible health factors, such as exercise habits, leisure activities, food and drug habits, perceived stress during leisure time, relations to friends, loneliness, and time for oneself were asked on a 5-graded scale.

Measurements of aerobic capacity: The measurement of aerobic capacity was estimated from cycle ergometer tests. Two experienced test leaders conducted the tests.

Statistical analyses

Statistical analyses used in the four studies are summarised in table 3.

Table 3. Statistical analyses used in the studies. Number of subjects is indicated.

Statistics	Study I n=3,831	Study II n=55	Study III n=10	Study IV n=140
Mean, Standard Deviation (SD), Range	3,831	55		140
Prevalence	3,831	55		140
Differences of proportions 95% Confidence Interval (C.I.)	3,831			140
Logistic regression, odds ratios and 95 % C.I.	3,831			
Chi square test		55		
Two paired t-test		32		140
Pearson correlation coefficient (inter-rater frequency and inter-rater durations)		12		
Heart rate increase in per cent of possible heart rate increase (% HRR)			8	

Study I

Regarding general health, the number and percentage of individuals were computed for those who answered “fair” or “poor” health, which was classified as “poor general health”. The sum of scores for all questions on mental health was dichotomised at the 75th percentile and those who scored above the 75th percentile were classified as having “reduced mental health”. Psychosomatic symptoms were computed for those who answered “Yes, often (every week)”. Musculoskeletal symptoms were computed for those who answered “Yes” to the question: “Have you at any time during the last 3 months been troubled with pain, aches or discomfort in any body part shown in the picture? If yes, in which part?” The number of musculoskeletal symptoms per individual were also summarised in four groups: no symptoms at all; one to two symptoms; three to four symptoms; and more than four symptoms.

Logistic regression analysis was conducted to calculate odds ratios (OR) and 95 % confidence intervals (95 % C.I.) for estimated risk of adverse health effects associated with level of education of women and men. Men with post-secondary education were used as a reference group (OR = 1), as they reported fewer health complaints compared with all the other groups.

Cross-tables were used to calculate number and relative frequency of individuals exposed to physical, psychosocial and organisational risk factors at work. Questions with more than two response alternatives were dichotomised at the 75th percentile.

The number and relative frequency of individuals exposed to standing and walking postures in unpaid activities were computed for those who answered more than two hours in a normal working day, or more than five hours in a normal non-

working day. Perceived physical exertion in unpaid work was dichotomised at the 75th percentile.

Outcomes of smoking habits were dichotomised at more or fewer than 10 cigarettes per day, and physical exercise at more or less than twice per week.

The difference between women and men (W-M) in prevalence of symptoms and exposures was expressed in difference between proportions with 95% confidence intervals (Gardner & Altman 1989). Differences were statistically significant when C.I.>1 or C.I.< -1.

Study II

Questionnaire data were computed as mean and range values distributed on men and women. Chi square tests were used to calculate differences between men and women with regard to musculoskeletal symptoms.

Interview data were computed as mean and range values distributed on men and women. Two-tailed paired t-tests were used to calculate differences between men and women in leisure activities.

From the observation data, collected by video recording, ten activities (work tasks and postures) were chosen to be analysed. The activities chosen were known as risk factors for developing musculoskeletal symptoms, e.g. working with hands above shoulder height, working in a stooping posture and repetitive movements for the wrists (Bernard 1997, Hagberg et al 1995). Other activities were chosen to cover the whole work cycle (e.g. natural short breaks and working in a neutral work posture) (Table 4).

Videotapes were analysed using the FIT system, Flexible Interface Technique (Held et al 1999, Held 2000). Hardware consisted of a hand-held computer (Palm III x) with a touch screen (Figure 1). On a template covering the touch screen, symbols were drawn of all the chosen activities. By typing with a pencil on a symbol, activity and time were stored in the hand-held computer's memory. Via an interface, data were transferred from the hand-held computer to a personal computer. FIT system software and a standard calculation program were used to calculate frequency, real time and percentage of observed time for each activity. Further analyses, such as calculating mean values, ranges and tests of differences between men and women, were done in SPSS/Windows ver. 10.0.

Results from the video analyses have been tested and re-tested concerning accuracy and repeatability on an inter- and intra-personnel level by two experienced ergonomists. The weight of tools and metal sections was measured before the analyses.

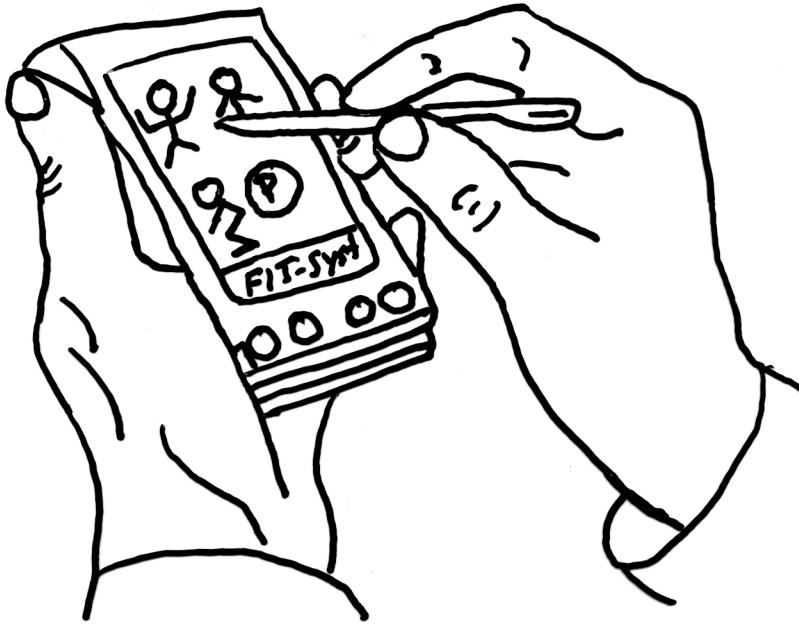


Figure 1. Hand-held computer, template and touch screen.

Table 4. Observed activities included in the FIT-system analyses.

Handling materials at and above shoulder height
Handling materials (> 1 kg) below shoulder height but above knee height
Handling materials in and below knee height in a stooping posture
Handling materials in a crouching or kneeling posture
Tightening or loosening cramps at and above shoulder height
Tightening or loosening cramps below shoulder height but above knee height
Tightening or loosening cramps in a stooping posture
Tightening or loosening cramps in a crouching or kneeling posture
Natural short breaks (e.g. standing with arms hanging down without a load or arms in an obvious resting position)
Miscellaneous (e.g. walking without a burden, writing, handling materials weighing less than 1 kilo, pressing buttons)

Study III

Data collected in the structured interviews were processed qualitatively to reflect the contents of the interviews, e.g. disturbances during work affecting whether the

study person could perform her work. The answers (e.g. to the question about demands at work) were grouped by occupational category, and issues commented on by several interviewees were also emphasised in the results. In the presentation of the results, special attention was paid to frequently recurring themes.

Data on heart rate measurements and ratings of physical exertion were processed manually and using computer programs. For each study person, a mean value and a maximum and minimum heart rate value during work were calculated. Heart rate increase as a percentage of possible heart rate increase was calculated according to $\%HRR^1 = 100 \times (HR_{work}^2 - HR_{rest}) / (HR_{max} - HR_{rest})$ to obtain an opinion about the cardiovascular load during work. HR_{work} is the average heart rate during a work shift. Standard values for heart rates at rest are approximated to 70 for women (Asmussen et al 1961, Kilbom 1971, Wigaeus Hjelm et al 1995). Maximal heart rate has been calculated according to the formula $(HR_{max} = 210 - (0.662 \times \text{age}))$ (Bruce et al 1973).

Heart rate curves were compared with and analysed in relation to observed duration and frequency in a sitting, standing or walking posture. A comparison of observed activities and heart rate curves was also made.

Study IV

The initial question from the interviews was transcribed verbatim and the answers have been listened to and read several times and then categorised into themes. The other answers from the semi-structured interview have been listened to, concluded and categorised into themes.

Potential health-promoting factors (dichotomised) were analysed as follows. Numbers (n) and proportions (%) were calculated for each answer and distributed on the “Healthy group” and the “Others”. When analysing differences of proportions between the healthy group and the others, 95% Confidence Interval (C.I.) was used, based on *Statistics with confidence* (Gardner & Altman 1989). Differences were statistically significant when the $C.I. > 1$ or $C.I. < -1$.

The aerobic capacity of each individual was estimated from heart rate and work-load in a sub-maximal test of dynamic legwork on a cycle ergometer. Maximal oxygen consumption was estimated from the heart rate (Sports tester, Polar Electro, Finland) measured during the fifth and sixth minutes of sub-maximal workloads according to the monogram of Åstrand and Rhyming (1954) and corrected for age according to Åstrand (1960). Aerobic capacity was expressed as maximal oxygen consumption per minute, and kilogram body weight as was used by Karlqvist et al (2003).

Mean values and comparisons of means between the groups have been calculated using an independent samples test, t-test.

¹ HRR = Heart Rate Range

² HR = Heart Rate

Results

Working conditions in low-educated women

Exposures at work

In study I, results of exposures at work were presented for three levels of educational background (see Table 1). In order to simplify the results in the thesis, only women and men in education category 1 and 3 are referred.

A large proportion of the low-educated women were exposed to e.g. bending and twisting movements, repetitive finger movements, stationary standing postures and work with hands above shoulder height (Table 5).

The work exposure of the low-educated women was compared with the low-educated men. More women than men were exposed to sedentary work, stationary standing postures and repetitive finger movements. On the other hand, more men than women were exposed to work with hands above shoulder height, manual handling, work on vibrating surface and work with vibrating tools (Table 5).

Nearly 50 % of the women reported that they had low control over their work and 32 % reported high demands. Job strain, i.e. low control and high demands was reported by 11 %. Regarding psychosocial work exposures there were no statistically significant differences compared with low-educated men, except that more men than women reported poor social support from colleagues. More low-educated than high-educated women reported low control at work, while more high-educated women reported high demands. Minor differences were noted regarding social support from supervisors and colleagues (Table 5).

Almost 50 % stated that they were unable to adjust work tasks when not feeling well, and more than 20 % reported that it was difficult to stay at home for shorter illnesses. No statistically significant differences compared with the men were noted regarding organisational factors (Table 5).

Table 5. Exposures at work.

	Low-educated			High-educated		
	Women (n=365) %	Men (n=371) %	W-M 95 % C.I.	Women (n=539) %	Men (n=348) %	W-M 95 % C.I.
<i>Physical work exposure</i>						
Sedentary work	27	17	10(4-16)	31	49	-18(-25- -12)
Stationary standing posture	33	20	13(7-20)	13	6.4	7(3-11)
Work with hands above shoulders	32	40	-8(-15- -1)	8.3	10	-2(-1-2)
Repetitive finger movements	49	40	9(2-17)	21	23	-2(-1-4)
Bending and twisting movements	58	54	4(-4-11)	25	17	8(2-13)
Manual handling 5-15 kg	33	62	-29(-36- -22)	23	17	7(1-12)
Manual handling above 15 kg	28	57	-29(-36- -22)	16	14	2(-3-7)
Work on a vibrating surface	8.4	45	-36(-42- -30)	2.5	11	-9(-12- -5)
Work with vibrating tools	9.9	51	-41(-47- -35)	3.8	15	-11(-15- -7)
<i>Psychosocial work exposure</i>						
Poor social support from supervisors	42	46	-4(-11-3)	47	45	2(-5-9)
Poor social support from colleagues	24	34	-10(-17- -3)	26	32	-6(-12-0)
High demands at work	32	27	6(-1-13)	44	36	8(1-15)
Low control at work	47	40	7(-1-14)	11	9.9	1(-3-6)
Job strain	11	8	3(-2-7)	3.5	2.9	1(-2-3)
<i>Work organisation</i>						
Negative changes in working conditions during the last year	19	20	-1(-8-6)	22	19	3(-3-10)
Not able to adjust work tasks when not feeling well	45	46	-1(-8-6)	47	31	17(10-23)
Often difficult to stay at home for short illnesses	23	21	2(-4-3)	40	33	7(1-14)

In study II, work exposure was measured by calculating frequency and percentage of total time for 10 exposure variables. A summary of the results showed that the women worked 9.1 % of their total working time with their hands at and above shoulder height, 4.6 % of the total time in stooping postures and 3.1 % in crouching or at a kneeling posture.

Compared with the men, the main differences were that women worked more frequently and during longer periods with hands at and above shoulder height. Regarding work in a stooping posture and in a kneeling posture, the exposures were about the same.

In study III, the results of the psychosocial work exposures can be summarised as follows: The food distributors reported low levels of control, high time pressure but good social support. The cooks seemed to have good decision latitude, just occasionally time pressure and good social support. The cleaners seemed to have fairly good work control, no time pressure and good social support from colleagues. All groups seemed to feel that their work was important and that they got appreciation from their customers.

The measurement of heart rate during a whole work shift showed that three of the food distributors exceeded 30 % HRR, which is the recommended upper limit for an eight-hour working day when the work also involves uncomfortable working postures and material handling (Jørgensen 1985, Wigaeus Hjelm et al 1995). However, none of the food distributors worked full-time; neither the cooks nor the cleaners reached that limit. The measurements of self-rated physical exertion showed that the food distributors, more than the cooks and the cleaners, rated their degree of physical exertion as higher in the morning and in the middle of the day, but lower than one of the cleaners in the afternoon.

The food distributors rated their physical exertion between 10 and 13 in the morning before they started working, and between 13 and 17 around midday. In the afternoon all the subjects rated their exertion as 11. The cooks and the cleaners rated their physical exertion in the morning between 7 and 10, between 13 and 14 during midday and between 9 and 14 in the afternoon (See figure 2).

- 6 - Very, very light (Resting)
- 7 -
- 8 -
- 9 - Very light - gentle walking
- 10 -
- 11 - Fairly light
- 12 -
- 13 - Moderately hard - steady pace
- 14 -
- 15 - Hard
- 16 -
- 17 - Very hard
- 18 -
- 19 - Very, very hard
- 20 - Exhaustion

Figure 2. Borg's 15-point scale (6-20).

Follow-up

The overall impression was that the food distributors, in several respects, had a difficult work situation that ought to be improved.

By adding two food distributors and leasing another car, the total load would be reduced and divided more equally during the day. These actions would considerably reduce the stress and the cardiovascular load during work, and increase the workers' satisfaction. It would also make it possible to re-distribute the routes. As a short-term solution, extended delivery times would reduce time pressure.

Combining jobs was a suggestion that came from the employers and the staff; we also support it. These jobs could be a combination of e.g. working as an assistant cook some days and as a food distributor other days. Another possibility was to combine office cleaning and food distribution. By combining jobs, it would also be easier to create full-time jobs, making it possible for everybody to live on their salary. Combinations create more variation over the week. Both the cardio-

vascular and musculoskeletal loads would be more evenly distributed by doing more varied tasks.

The employer attended to some suggested short-term solutions and also began to plan for the long-term solutions; a follow-up six months after the intervention showed that working conditions had improved. A reduction of cardiovascular load as well as self-rated physical exertion was noted, and the work was perceived to be substantially less stressful. After the intervention, even the food distributors got values that did not reach 30 % HRR.

The intervention showed that it is possible to change the working conditions for a group of women who are exposed to great strain. The study may serve as an example of ergonomic fieldwork that should also be conducted by e.g. the company health service.

Exposures in unpaid work

In study I, 35% of the low-educated women reported that they worked more than two hours in a normal working day on household and maintenance work. During a normal non-working day, 22 % worked more than 5 hours per day (Table 6). Household and maintenance work was defined as standing or walking postures, e.g. doing the dishes, buying food, washing, cleaning, taking care of children, car maintenance and house repairs.

In study II, mean time worked in such tasks during a working day was 3.1 hours, and in a typical non-working day 5.7 hours for the females. In both studies, more women than men spent statistically significantly more time in unpaid work. In study I, hardly any differences were noted compared with the high-educated females. There were also significant differences in perceived exertion between both the low- and the high-educated women compared with the men (Table 6).

Table 6. Household and maintenance work.

	Low-educated			High-educated		
	Women (n=365)	Men (n=371)	W-M	Women (n=539)	Men (n=348)	W-M
	%	%	95 % C.I.	%	%	95 % C.I.
Household and maintenance work more than 2 hours during a normal working day	35	11	24(18-29)	38	12	25(22-29)
Household and maintenance work more than 5 hours during a normal non-working day	22	11	11(6-16)	26	16	10(6-13)
Perceived physical exertion in unpaid work during a normal working day	32	22	10(4-17)	29	20	8(5-12)

Lifestyle measures

In study I, 26 % of the low-educated women reported that they smoked more than 10 cigarettes per day. Low-educated women were the group with the highest

prevalence of smokers compared with all men and women with a higher education (Table 7). In study IV, 76 % from the healthy group and 65 % of the “others” reported that they were not smokers (Table 11).

Seventy-eight per cent in study I, reported that they exercised in some form and 55 % reported that they exercised more than twice a week. Exercise was defined as sports, aerobic training, gymnastics, dance, going for walks, cycling etc. during at least 30 minutes per occasion (Table 7).

In study IV, 63 % of the “healthy” group and 43 % of the “others” stated that they exercised at least 1-2 times a week (Table 11).

In study I, mean value for body mass index (BMI) was calculated to 25 kg/m². In study IV the mean value of the healthy group was 27 and for the others 28 kg/m² (Table 9 and 10). As much as 64 % of the “healthy group and 83 % of the others had BMI values over 25. BMI values between 25-29.9 are defined as overweight, according to WHO norms (WHO 1995a).

Table 7. Lifestyle.

	Low-educated			High-educated		
	Women (n=365)	Men (n=371)	W-M	Women (n=539)	Men (n=348)	W-M
	%	%	95 % C.I.	%	%	95 % C.I.
Smoking more than 10 cigarettes a day	26	23	3(-3-10)	8	9	-1(-5-3)
Physical exercise in any form	78	73	5(-1-12)	90	78	12(7-17)
Physical exercise more than twice a week	55	46	8(1-15)	63	55	8(1-15)

Health in low-educated women

Prevalence of self-reported health outcomes was examined in three of the studies. In these studies the health of low-educated women was compared with that of low-educated men, and/or with that of other women and men with higher education. Self-reported musculoskeletal symptoms have been examined in studies I and II. Self-reported general health has been examined in studies I and IV. Self-reported mental health and psychosomatic symptoms have been examined in study I. In study IV, health-promoting factors were in focus.

Self-reported musculoskeletal symptoms

In studies I and II the prevalence of musculoskeletal symptoms among the women was high. For example, 50 % of the women reported that they had had symptoms in the neck some time during the last three months. In study I, 39 % reported symptoms in the shoulders; for female industrial workers the figure was 74 %. More than 60 % of the industrial workers reported symptoms in the wrists/hands. In both studies about 50 % reported symptoms in the low back (Table 8).

In studies I and II, women were compared with men who had the same educational background and men who had the same type of work tasks. These comparisons showed that the women had the highest prevalence of symptoms in most

body parts. In comparison with the high-educated women, significantly more low-educated women reported symptoms from most body parts (Table 9).

Table 8. Prevalence of musculoskeletal symptoms during the last three months among low-educated women.

Part of body	Low-educated (n=365)	Industrial workers (n=23)
	%	%
Neck	50	50
Shoulders	39	74
Wrists/hands	19	61
Low back	50	52
Hips	20	30
Knees	25	35

In study I, the number of self-reported musculoskeletal symptoms was also counted for each individual. These results showed that 46 % of the low-educated women reported that they had had more than four symptoms. Only 16 % had had no symptoms at all, during the last three months. Significantly more women than men reported more than 4 symptoms, and more men than women reported no symptoms at all. When comparing the low-educated women with the high-educated women there were also significant differences in numbers of musculoskeletal symptoms. More low-educated than high-educated reported more than four symptoms (Table 9).

Self-reported general health

In study I, 27 % of the low-educated women self-reported their general health as fair or poor. When comparing the same age group of low-educated women in studies I and IV, 44 % in study I and 43 % in study IV were reporting fair or poor general health.

In study I, no statistically significant differences were noted between the low-educated women compared with the men who had the same educational background. However, statistically significant differences were shown compared with the high-educated women, where 19 % reported fair or poor general health compared with 27 % of the low-educated women (Table 9).

Self-reported mental health

Thirty-one per cent of the low-educated women were classified as having reduced mental health. There were no statistically significant differences compared with the low-educated men. Compared with the high-educated women statistically significant differences were shown. More low-educated women reported reduced mental health (Table 9).

Self-reported psychosomatic symptoms

Self-reported psychosomatic symptoms were measured only in study I. Thirty-three per cent of the low-educated women reported that they often (every week)

felt fatigue, 16 % reported frequent headaches and 17 % reported often having sleeping problems, at least once every week. Compared with the low-educated men, more women self-reported fatigue and headache. More high-educated than low-educated women reported fatigue, but not headache and sleeping problems (Table 9).

Table 9. Comparison of health outcomes between low- and high-educated women.

	Low-educated n = 365	High-educated n = 539	L-H
	%	%	95 % CI
Musculoskeletal symptoms			
Neck	50	43	6(0-13)
Shoulders	39	29	10(4-17)
Wrists/hands	19	12	7(2-12)
Low back	50	39	11(4-17)
Hips	20	18	2(-3-8)
Knees	25	20	5(-1-10)
Number of musculoskeletal symptoms			
No symptoms at all	16	24	-8(-13- -3)
More than 4 symptoms	46	32	14(7-20)
Poor general health	27	19	9(3-14)
Reduced mental health	30	23	8(2-14)
Psychosomatic symptoms			
Fatigue	33	45	-12(-19- -6)
Headache	16	15	0(-4-5)
Sleeping problems	17	19	-2(-7-3)

Risk of adverse health effects

In study I, risk indicators of adverse health effects were computed using logistic regression, and were expressed as odds ratios (OR).

Compared with the reference group of post-secondary educated men, both high- and low-educated women and low-educated men showed statistically significant higher odds ratios of poor general health and reduced mental health. For the low-educated women, the odds ratio of poor general health was more than three times higher, and the odds ratio of reduced mental health was more than twice as high.

The odds ratio of headache at least once every week was three times as high, and having sleeping problems nearly twice as high (Table 10).

The low-educated women also showed a higher odds ratio than the reference group, for musculoskeletal symptoms in all examined body parts except for the knees. For example, the odds ratio of neck symptoms was more than twice as high, of symptoms in the shoulders 3.5 times higher, and in the wrists/hands 6.8 times higher (Table 10).

Table 10. Risk of adverse health effects expressed as odds ratios (OR). Reference group is high-educated men.

	Women				Men		
	Low-educated		High-educated		Low-educated		High-educated
	OR	95 % C.I.	OR	95 % C.I.	OR	95 % C.I.	OR
Poor general health	3.2	2.3-4.4	1.5	1.1-2.1	2.7	1.9-3.8	1
Reduced mental health	2.3	1.7-3.1	1.5	1.0-2.0	1.9	1.3-2.6	1
<i>Psychosomatic symptoms</i>							
Fatigue	1.4	1.0-1.8	2.1	1.6-2.8	0.9	0.6-1.2	1
Headaches	3.1	2.0-4.9	2.7	1.7-4.4	1.1	0.7-1.9	1
Sleeping problems	1.8	1.2-2.6	1.7	1.2-2.5	1.5	1.0-2.2	1
<i>Musculoskeletal symptoms</i>							
Neck	2.3	1.6-3.3	2.1	1.5-2.9	1.1	0.8-1.5	1
Shoulders	3.5	2.3-5.2	2.4	1.6-3.5	1.7	1.1-2.6	1
Wrists/hands	6.8	3.3-13.9	4.4	2.1-9.1	4.1	1.9-8.5	1
Low back	1.5	1.1-2.1	1.1	0.8-1.5	1.5	1.1-2.1	1
Hips	3.2	1.9-5.4	3.1	1.8-5.2	2.4	1.4-4.1	1
Knees	1.0	0.7-1.5	0.9	0.6-1.3	1.8	1.2-2.5	1

Health promotion factors

On the basis of the interview results with 20 women who had self-reported their health as good or very good, and who had not had any recurrent sick leave or long periods of sick leave during the last two years, a hypothesis was defined. “Being physically active and having high aerobic capacity are associated with self-rated good health in low-educated, gainfully employed, older women”.

The hypothesis was then tested against results from a questionnaire and measurements of aerobic capacity. The questionnaire results showed statistically significant differences between the healthy group and the others regarding three factors that are connected to physical activity. Firstly, more women from the healthy group exercised at least once or twice per week. Secondly, more women from the healthy group often or very often performed physical activities such as going for walks, cycling, outdoor life, dancing, skating, and gardening, compared with the others. Thirdly, more women from the healthy group had a normal BMI (Body Mass Index) than the others (Table 11). These results clearly support the first part of the hypothesis: “Being physically active is associated with self-rated good health”.

Also the mean values from the individual aerobic capacity tests showed a statistically significant difference between the groups. The healthy group had a higher aerobic capacity than the others.

Table 11. Comparison of health factors between the healthy group and the others.

Health factors	“The healthy” (n=80)		“The others” (n=60)		H-O
	n	%	n	%	95% CI
Exercise at least once or twice a week	50	63	26	43	19(3-36)
Sometimes or often participate in leisure activities, such as going to the cinema or theatre, having coffee with friends, going to a pub, watching sports	43	54	26	43	10(-6-27)
Often or very often do physical activities, such as going for walks, cycling, outdoor life, dancing, skating, gardening	57	72	27	45	26(10-42)
Seldom or never feel stress during leisure time	55	70	33	55	14(-2-30)
Seldom or never perceive involuntarily loneliness	67	85	46	77	7(-6-21)
Good and really good relationships with friends	78	99	53	88	9(0-18)
Enough time for myself	46	58	27	45	13(-4-29)
Normal BMI, 18.5-24.9	29	36	10	17	20(5-34)
Often or very often good food habits	71	90	49	82	7(-5-19)
Non-smoker	60	76	39	65	10(-5-25)
Alcohol consumption: twice or less than twice a month	72	91	49	82	8(-3-20)

Discussion

In this thesis, low-educated women's health and conditions at work and at home were examined. The overall aim was to gain a deeper understanding of low-educated women's conditions at work and in the domestic sphere, and how this affects their health. Methods used were questionnaires, interviews, observations and direct measurement.

The empirical basis was women and men working in the county of Östergötland. Four studies have been conducted. Each study has its own approach regarding methods and subjects.

The first study was a cross-sectional population-based study including 3,831 gainfully employed women and men. The aim was to study differences in health and exposures between women and men with the same length of education. In the second study women and men performing the same type of work tasks were compared regarding work technique and the prevalence of musculoskeletal symptoms. It was conducted at an industry and included 55 blue-collar workers. The third study was an intervention study that aimed to examine the physical and psychosocial working conditions among a group of female hot food distributors. Their conditions were compared with other women in traditionally heavy work within the same work unit and improved work conditions were suggested. The fourth and final study had an exploratory approach combined with questionnaire data and measurements of aerobic capacity. The aim was to look for factors that are associated with self-rated good health outside the paid work in low-educated, gainfully employed, older women.

The segregated labour market

One of the main findings in study I was that men and women work in different sectors of the labour market, irrespective of educational background. The women worked mainly in the public sector and the men in the private sector. There were also great differences between men and women when comparing the most common job titles in each educational category. Women and men still seem to select totally different types of occupations.

Many other studies support these results, and the strictly gender-segregated labour market is certainly one major explanation for the differences in work exposures between women and men (Gonäs & Spånt 1997, Rubery & Fagan 1993, Siltanen et al 1995). Studies have also shown that in those cases when women and men do have the same job title, they still do not perform the same type of work tasks (de Zwart et al 2001, Messing et al 1994). Furthermore, as in shown in study II, even if women and men have the same type of work tasks they are differently exposed due to the fact that the workplace was designed for males; or, if we look at it the other way around, due to biological differences between women and men regarding e.g. height (Dahlberg et al 2004).

According to Pirooska Östlin, explaining occupational segregation by gender can be classified into three partly overlapping categories: 1. Theories on gender roles and sex stereotyping of work. 2. Institutional and labour market segmentation theories and 3. Neo-classical and human capital theories (Östlin 2001).

1. Gender roles and sex stereotyping of jobs. The basis of this model is the belief that there are systematic biologically or socially determined differences between women and men as regards for example interests, skills, abilities, willingness, physical strength, manual dexterity and caring nature, which explains the gender division of labour. In this thesis, several examples of this division of labour were found. In study I, where work exposure differed significantly between women and men in all educational categories, for example more women than men were exposed to repetitive finger movements and more men than women to manual handling of heavy weights and work with vibrating tools. Another example can be seen in study III, where all food distributors employed were women; the fact that these kinds of work tasks were only performed by women was certainly not by chance. However, in study II, women and men performed the same work tasks, but in that study we really searched for such a workplace.

This gives a “naturalistic” perspective to gender inequalities in work, since differences between men and women can be seen as being functional. It is important to note that in many societies the “women’s” tasks entail no direct payment, no protective legislation, no social security and low social status. When these tasks are performed as waged work, they are usually given a low value in terms of both payment and status.

2. Institutional and labour market segmentation theories. One basic assumption in established economic theories regarding the demand for labour is that employers weigh costs against benefits when hiring a person for a particular job. According to this approach, discrimination does not exist in this process, as employers will either hire the person who is the most productive at a given price, or the person who produces a given amount of goods or services at the lowest possible cost. However, according to institutional theories, discrimination could still exist in this area, mainly due to the segmentation of labour markets (England et al 1988). This was clearly confirmed in study I, where most women worked in the public sector and most men in the private sector, irrespective of educational background. In reality it is difficult for certain groups of workers to move easily in and out of different labour market segments. When the working conditions in a segment are favourable, those employed in that segment often use social exclusion strategies to preserve privileges associated with working in it. The selection mechanism used in determining who is hired, fired and promoted is often biased by gender, race or ethnicity (Burchell & Rubery 1994, Tomaskovic-Devey 1993).

3. Neo-classical and human capital theories. According to the neo-classical theory, the human capital of women is less than that of men, regarding both the

resources they bring to the labour market (e.g. education) and their labour market experience, the latter being negatively affected by continual interruptions of work due to marriage and childcare responsibilities. Because of their lower educational level and less experience, women are viewed as less productive, which “explains” why women earn less and why they “prefer” certain types of occupation.

According to study I, this was not found regarding educational level. More women than men had high education in the random sample (26 % compared with 20 %). Neo-classical economists assume that women’s choice of occupation is rational, as they prefer jobs where the negative consequences of occasional interruptions are minimal. According to this approach, one of the reasons for employing men for certain types of jobs is the belief that female workers cost employers more than male workers (Anker 1998).

Work exposure

A considerable proportion of the low-educated women were often exposed to awkward work postures such as: bending and twisting movements, repetitive finger movements, stationary standing work postures, work with hands above shoulder height and heavy manual handling. More of the low-educated women compared with the low-educated men were exposed to sedentary work, stationary standing postures and repetitive finger movements. However, more of the men than the women were exposed to work with hands above shoulder height, manual handling, work on a vibrating surface and work with vibrating tools. In other studies most of these physical work exposures have been shown as risk factors for developing musculoskeletal symptoms (Bernard 1997, Hagberg et al 1995). These differences in physical work exposure between women and men can partly be explained by the segregated labour market.

A large proportion of the low-educated women reported low control at work and high demands. Job strain, i.e. low control and high demands was reported by 11 % of the low-educated women compared with 8 % of the low-educated men and with 4 % of the high-educated women. Furthermore, about 40 % of the low-educated women reported poor social support from supervisors, and one in four reported poor support from colleagues.

Poor psychosocial working conditions, in the form of high demands, low control and weak social support at work, have all been shown to have a close relationship with reduced psychological well-being (Karasek & Theorell 1990, Östlin 1996).

Even when comparing women and men performing the same type of work tasks we found that they are differently exposed. This finding is rarely documented in the literature. In our study the analyses suggested that this depended on factors of workplace design. The work heights were not adapted to fit women who are on average shorter than the men. A consequence was that they had to work with their hands at or above shoulder level more often than men, which other studies have

shown to be a risk factor for developing MSD (Fredriksson 2000, Bernard 1997). Due to their smaller hands, women also had to work more frequently and during longer periods compared with men in tightening and loosening cramps, which was a very common work task at that workplace. A few studies have compared computer work technique between men and women. Karlqvist (1997) found that when using computer input devices, women elevated and rotated their shoulder joints more than men, and they had a higher EMG activity in the muscles examined. Another recently published study found that when women used the computer mouse, they worked with higher relative muscle activity in the extensor digitorum muscle than men did, and, when pressing the mouse button, they used more force relative to their maximal capacity than men (Wahlström 2001).

Summarising: according to our studies, differences between low-educated women and men's work exposure could be explained both by the gender segregated labour market and by workplace design factors. A high proportion of low-educated women and men were exposed to risk factors that according to earlier literature can cause musculoskeletal disorders and reduced psychological well being.

Household and maintenance work

Great differences in time spent on unpaid work at home were found between low-educated women and men in study I, but also between the high-educated women and men. Women spent considerably more time on household and maintenance work (in standing or walking postures). Thirty-five per cent of the low-educated females reported that they worked more than 2 hours a day in a normal working day, compared with 11 % of the men. During a normal non-working day, 22 % reported that they worked more than 5 hours a day compared with 11 % of the men.

In study II, the same tendency was shown. The women spent significantly more time on unpaid work than the men in a typical non-working day. These results indicated a higher total workload for women, since they had about the same number of paid working hours as the men. How this uneven distribution of unpaid work affects health has not been evaluated in this thesis. However, it is most likely that the additional exposure from the unpaid work will affect the prevalence of musculoskeletal symptoms.

Björkstén found that the combination of being gainfully employed with monotonous work tasks, often with hands and arms lifted, and being responsible for home duties seemed to cause a risk of developing neck problems among unskilled female workers (Björkstén 1998). Lundberg recently found that a possible explanation for the strong relation of work-related upper extremity disorders among women could be that women often perform repetitive tasks and are exposed to additional stress from unpaid work (Lundberg 2002).

In the MOA study (Modern Work and Living Conditions for Women and Men), it was shown that women spent on average nearly twice as much time on unpaid work per week as men (Härenstam et al 2003). Other studies that have shown the

difficulties, especially for women, to combine paid work and unpaid work are Frankenhaeuser et al 1989, and Lundberg and Frankenhaeuser 1999. Their research on stress levels during and after work showed that whereas men generally unwind rapidly at the end of the working day, women's stress levels remain high after work, particularly if they have children living at home (Frankenhaeuser et al 1989, Lundberg & Frankenhaeuser 1999).

Health in low-educated women

The main findings regarding health in low-educated women are:

Half of the women in study I reported that they had had symptoms in the neck or low back some time during the last three months. Nearly half reported more than four musculoskeletal symptoms. About one fourth self-reported their general health as poor, and more than one third self-reported reduced mental health.

In order to assess whether these proportions are high or not, they must be related to other groups. Regarding musculoskeletal symptoms there were significant differences compared both with the groups of men and the high-educated women. Compared with low-educated men the women reported a higher prevalence of musculoskeletal symptoms in the neck, shoulders and wrists, but not in the low back. More women than men reported that they had more than four musculoskeletal symptoms. Low-educated women compared with high-educated women reported a higher prevalence of musculoskeletal symptoms in the shoulders, wrists/hands and low back.

There were no significant differences regarding general health and reduced mental health compared with the low-educated men. However, a significant difference was shown in comparison with the high-educated women. A greater proportion of low-educated women reported both poor general health and reduced mental health.

Many of these findings have also been reported in other studies. For example, musculoskeletal symptoms are much more common among women than among men. This is a well-known fact that has often been discussed in the literature, especially with regard to neck and shoulder symptoms (Kilbom & Messing 1998, Punnett & Herbert 2000, de Zwart et al 2001).

Another finding was that women in general report worse health than men, irrespective of educational background. Differences in prevalence of musculoskeletal symptoms were most obvious, but more high-educated women than men also reported worse general health and reduced mental health.

Differences in self-reported general health between socio-economic groups have also been shown in earlier studies. Inequalities in self-reported morbidity have proved to be substantial everywhere and nearly always in the same direction: persons with a lower socio-economic status have higher morbidity rates (Kunst et al 1995, Lahelma & Arber 1994). However, in a study of differences in self-reported morbidity by educational level, where 11 Western countries were compared, the authors found that the extent of inequalities in health varied between

countries. In general, there was a tendency for inequalities to be relatively large in the Scandinavian countries and to be relatively small in Spain, Switzerland and Germany (Cavelaars et al 1998). It is remarkable that health inequalities are not necessarily smaller in countries with more egalitarian policies such as the Scandinavian countries. According to Stronks et al, lesser socio-economic inequalities in health were found among women than among men in the Netherlands (Stronks et al 1995). This thesis showed that there were significant differences between low- and high-educated women in nearly all measured health indicators. This probably depends on the fact that more women participate in the labour market in Sweden compared with the Netherlands.

Because of the cross-sectional design of study I, no causal relationship can be given between health outcomes and e.g. work exposures. However, if we look at the results of the significant differences in work exposures between women and men, and also between the low- and the high-educated, there seem to be associations between health outcomes and work exposures. The uneven distribution of unpaid work between low-educated women and men was also obvious both in study I and study II. Furthermore, irrespective of educational background, women spent significantly more time in unpaid work than men. We can only speculate about what this means in terms of health outcomes, but it is most likely that the unequal distribution of unpaid work affects women's health negatively.

The biological differences between men and women probably have an impact on health status, but these differences cannot explain why women to such a great extent have worse health than men do. This thesis has shown other possible explanations e.g. the segregated labour market and workplace design factors. Some studies have shown that women are more likely to express or report musculoskeletal symptoms than men. It has also been suggested that women report more symptoms simply because they are better at recognising, articulating and communicating their symptoms than men. The interpretation of the results is, however, not clear in the literature. The differences may be dependent on e.g. age, type of symptoms and phase of life cycle (Verbrugge 1989, Macintire et al 1999). More attention has been given to the different circumstances of men and women's lives, as an explanation for excess illness among women. Some of the most important factors are structural aspects of society, with differing conditions for women and men in the workplace, in relations between couples, in family life and in participation in social activities (Hall 1990, Lundberg 1990).

More women than men reported symptoms in the shoulders, even when performing the same type of work tasks. There was also a tendency that more women than men reported symptoms in the neck, wrists/hands and ankles/feet. The differences in prevalence of musculoskeletal symptoms when women and men perform the same type of work tasks have rarely been documented in earlier studies. Several researchers have argued that more research is needed to find out

whether women performing the same work tasks as men, to a greater extent than men, suffer from MSDs (Punnet & Herbert 2000, Kilbom & Messing 1998).

One of the possible reasons that a larger proportion of women self-reported more symptoms in the neck and shoulders can be explained by the fact that they had to work with their hands at and above shoulder level more frequently and during longer periods. The literature has shown that working in these postures presents a risk of developing neck and shoulder disorders (Kuorinka & Forcier 1995, Bernard 1997, Violante et al 2000). Another reason could be biological factors, as mentioned in the introduction, regarding differences in muscle strength in the upper extremities (Miller et al 1993).

It was also noted that the prevalence of wrist symptoms was higher among women than among men. This might depend on the fact that women's hands are on average smaller than men's, and therefore they have to work for a longer time to do the same work as men. Studies have shown, that in a job that demanded high finger precision, women used 20-30 % of their maximal strength compared with 10-15 % for men (Kadefors et al 1993, Miller et al 1993). The design of the cramps and the tools may not fit women's smaller hands and therefore they have to work harder and for a longer time to do the same job as men.

Health promotion

Most of the low-educated women at work reported good health, which is a circumstance that is also worth highlighting in this thesis. In the population-based study 1, nearly 75 % reported good, very good or excellent general health.

Being physically active proved to be an important factor for perceived good health for low-educated, older women working in social care. Physical activity in moderate doses is probably also an important factor for all individuals to perceive good health. In study I, more than half of the low-educated women, and nearly half of the men, stated that they performed physical exercise more than twice a week. Among the high-educated the proportions were even greater.

A recent epidemiological study concluded that even low levels of physical activity, when performed regularly, have a beneficial effect on metabolic fitness and thus affect the overall health of the individual (Saltin & Pedersen 2002). A widespread recommendation is to achieve 30 minutes of moderate intensity activity (such as brisk walking) on at least five days of the week (WHO 1995b). Physical activity has been shown to have several benefits for the individual. Regular physical activity reduces mortality due to cardiovascular disease and coronary heart disease. It also prevents high blood pressure and is important for controlling diabetes, regulating weight and reducing the risk of osteoporosis and colon cancer (HAD 2000). A meta-analysis study concluded recently that moderate and high levels of physical activity are associated with reduced risk of total ischaemic and haemorrhagic strokes (Lee et al 2003).

The results from study IV naturally lead to a discussion that there ought to be profitable for employers to encourage physical activity. One way to facilitate physical activities for the personnel is to arrange suitable premises at or nearby the

workplace for fitness training. In some occupations, often male dominated jobs such as firemen and police officers, physical training during working hours is compulsory. Physical training ought to be compulsory also in physically demanding jobs dominated by females. If not compulsory the employer could subsidize physical training and by that increase the perceived health and it also might decrease sick leave. In a recently finished health project in Sweden women in the home care sector were offered physical activities three hours per week during work hours. The results showed that most of the participating women had increased their well being in terms of perceived better physical and mental health (Holmqvist & Leppänen 2004).

Lifestyle

More women than men seemed to exercise regularly, both among the low- and high-educated. In the literature there is evidence that regular exercise has good health effects (HAD 2000, Lee et al 2003, WHO 1995b). This fact does not seem to influence their health status if we look at the differences in health. However, if they did not exercise more than the men, the differences in health might be even greater.

Smoking habits did not differ significantly between low-educated women and men. However, when comparing low- and high-educated women and men there were great differences. More low-educated women and men were smokers compared with the high-educated.

Interventions

The intervention study showed that it is possible to change the working conditions of a group of women who were exposed to great strain. Ergonomic measurements of physical working conditions, as well as structured interviews to measure psychosocial working conditions, proved to be useful tools to detect these difficult working conditions for women in a typical female occupation.

The overall impression from study III was that the food distributors in several respects had a difficult work situation that ought to be improved. The food distributors reported high psychological demands and low decision latitude, time pressure and dissatisfaction with not being able to live up to the pensioners' and the employer's expectations. They also had a high increase in heart rate during work, which may be a risk factor for impaired health.

Several solutions were given, aiming to reduce and redistribute the total workload. The employer attended to some suggested short-term solutions and a follow-up showed that the working conditions had improved. A reduction of cardiovascular load, as well as self-rated physical exertion was noted and the work was perceived as substantially less stressful.

In order to function optimally at work, it is a prerequisite for employees to be able to regulate their physical workload, especially if it involves physically heavy elements. In the food distributors' case (as is the case for many women who are

gainfully employed), there are very few opportunities to influence how the work is to be performed or the work pace. This is confirmed in the results from study I, where a great proportion especially among the low-educated females reported low control at work.

As a result of the demographic development in Sweden the workforce is becoming older and older, and fewer people will have to provide for those who are not employed. It will therefore be economically necessary to design working life so that it is possible to work until retirement age.

An intervention was also planned in study II. However, during the study the management was changed twice and therefore it was impossible to perform an intervention. It would have been interesting to try to adapt the work heights and work tools so that the work environment would fit all employees, and then to conduct a follow-up where we measured exposures at work as well as the prevalence of musculoskeletal symptoms.

My conviction is that it is important and necessary to improve the work conditions and the work environment for all employees but especially for low-educated women in order to avoid work-related disorders in the future.

Methodological considerations

The issue for this thesis is complex. To have a gender perspective and to consider socio-economic factors at the same time is a challenge. However, I believe that it is sometimes valuable to have a wide approach when the issue is so complex. It would have been difficult to discuss low-educated women's health and working conditions without comparing with low-educated men, since Sweden has a segregated labour market that influences women's and men's work exposures differently. It would also have been difficult to discuss low-educated women's health and working conditions without taking socio-economic factors into consideration.

Working conditions can be measured in many ways. One advantage of this thesis is that all of the questions used in the questionnaires have been validated in other studies. Additionally, direct measurements to capture physical workload in two of the studies were used. Since my main interest is how physical work exposures affect health, the focus has been on physical work exposures but I have also tried to capture psychosocial exposure and organisational factors that in other studies have been shown to influence the health status of the individual. In order to get a more overall picture of what exposures might affect health, one additional approach has been to measure time spent on unpaid work, and how this differs between women and men.

Describing and comparing health status has been methodologically difficult. What is health and how do we measure it? In this thesis different aspects of illness were measured by self-reports. The focus has been on self-reported symptoms in the musculoskeletal system, since this was the main interest and the indicator of health status that in other studies has proved to differ most between women and men. Nevertheless, to get an overall picture of health also outcomes other indi-

cators of health status have also been measured but intentionally with less emphasis.

In study I, the dropout analysis showed that the non-response was not randomly distributed. To handle this, weights for sub-groups were created in order to compensate for the uneven response rate. The method used in that study is called RHG, Response Homogeneity Group (Sarndahl et al 1992). All analyses have been performed using these created weights, but we decided not to present the weighted analyses because they did not change the results in any significant way.

Because of the cross-sectional study design, no causal relationship could be given between exposures and health outcomes. Further studies with a longitudinal design are required.

The study sample in study II was relatively small, which means that no general conclusions can be drawn. However, combining results from the three methods used strengthens the reliability of the study. In the studied department, women were on average older than men (39 years compared to 33) and on average they also had a slightly longer period of service. Associations have been found between age and MSDs (Bernard 1997) and these associations were also found among men and women in this study. One might expect that those with a longer period of service would have a higher prevalence of musculoskeletal symptoms. This was true for the men but not for the women, where the opposite association was found. One explanation for this phenomenon among the women could be the “healthy worker effect”, which means that a selection of the women who became ill, left the workforce early and those with good health, stayed on at their employment (Last 1988).

In study III the size of the study group was small. Since so few people were studied, no general conclusions can be drawn. However, important experience was gained which can be useful for the municipality in the study, and to other workplaces planning to introduce or organise similar work. This study may serve as an example of ergonomic fieldwork with a gender perspective, rather than a study that can be used for drawing general conclusions.

One advantage of study IV was that three different methods were used. We were able to both define and test a hypothesis in the same study. This strengthens the reliability of the study, especially if the results go in one direction, which was the case in that study.

There might be a small selection bias in the study group. All employed persons in the municipality were offered the health-profile assessment and we also know that nearly everyone participated. However, it is possible that some women aged 45-65 in the social care department did not take the opportunity. If so, we assume that this small selection bias did not influence the results.

Because of the cross-sectional design we do not know if the healthy group exercised more often just because they were healthy, or if the exercise had made them healthier. However, all the women were working and in this respect had work ability. Further studies with a longitudinal design are required.

Need for further studies

This thesis has contributed to a deeper understanding of conditions at work and in the private life of low-educated women. It has also raised new research questions.

Further studies with a longitudinal design need to be conducted to be able to study the causal relationship between working conditions and health. For example, more research is needed to clarify the associations between differences in health between women and men, and the uneven distribution of unpaid work.

More research on generalised methods for intervention and health promotion would be preferable. For example, the ergonomic measurements as performed in this thesis proved to be important instruments to capture the working conditions, and started a development process in improving working conditions for the exposed women. From my earlier experience of prevention and rehabilitation work I believe that the management will listen much more carefully if you illustrate the problems in the work environment by figures. The observation measurements using the FIT system also proved to be a valuable instrument on this occasion; it was also easy to handle in practice and could be used e.g. for examining and improving work technique.

Research on health promotion is another area that needs to be developed. For example, it would be very interesting to conduct research on typical female workplaces where employees have been given great opportunities to take part in physical activity during working hours. Would that improve women's health?

Conclusions

The conclusions of this thesis can be summarised as follows:

Women with the same length of education as men are differently exposed; both in paid and unpaid work, due to the segregated labour market and the unequal distribution of domestic duties.

Low-educated women reported a higher prevalence of musculoskeletal symptoms in most body parts compared with low-educated men. Compared with high-educated women, low-educated women reported worse health in nearly all measured health indicators.

Even when women and men performed the same type of work tasks, more women than men reported a higher prevalence of musculoskeletal symptoms, especially in the shoulders. Besides differences in work technique, which can partly be explained due to the design of working heights and tools at the workplace, there were also differences in time spent on home and household work. The women spent significantly more time on household and maintenance work than the men.

Ergonomic measurements of physical working conditions and structured interviews to measure the psychosocial working conditions proved to be useful methods to detect the difficult working conditions for women in a typical female occupation. Organisational intervention that aimed to reduce and redistribute the physical and psychosocial workload was shown to improve the working conditions for the women exposed to great strain.

Being physically active is associated with self-rated good health in low-educated, gainfully employed women aged 45 to 64. However, recommended sufficient aerobic capacity does not need to have an association with self-rated good health for the same group.

Summary

Dahlberg R. (2005). *Health and working conditions among low-educated women*. Arbete och Hälsa 2005:9.

In this thesis, low-educated women's health and conditions at work and at home were examined. The overall aim was to gain a deeper understanding of low-educated women's conditions at work and in the domestic sphere, and how this affects their health. Methods used were questionnaires, interviews, observations and direct measurement.

The empirical basis was women and men working in the county of Östergötland. Four studies have been conducted. Each study has its own approach regarding methods and subjects.

The first study was a cross-sectional population-based study including 3,831 gainfully employed women and men. The aim was to study differences in health and exposures between women and men with the same length of education. In the second study women and men performing the same type of work tasks were compared regarding work technique and the prevalence of musculoskeletal symptoms. It was conducted at an industry and included 55 blue-collar workers. The third study was an intervention study that aimed to examine the physical and psychosocial working conditions among a group of female hot food distributors. Their conditions were compared with other women in traditionally heavy work within the same work unit and improved work conditions were suggested. The fourth and final study had an exploratory approach combined with questionnaire data and measurements of aerobic capacity. The aim was to look for factors that are associated with self-rated good health outside the paid work in low-educated, gainfully employed, older women.

The results of the studies can be summarised as follows:

Women with the same length of education as men are differently exposed in both paid and unpaid work, due to the segregated labour market and the unequal distribution of domestic duties. Low-educated women reported a higher prevalence of musculoskeletal symptoms in most body parts compared with low-educated men. Compared with high-educated women, low-educated women reported worse health in nearly all measured health indicators.

Even when women and men performed the same type of work tasks, more women than men reported a higher prevalence of musculoskeletal symptoms, especially in the shoulders. Besides differences in work technique, which can partly be explained due to the design of working heights and tools at the workplace, there were also differences in time spent on home and household work. The women spent significantly more time on household and maintenance work than the men.

Ergonomic measurement methods of physical working conditions and structured interviews to measure the psychosocial working conditions proved to be useful methods to detect the difficult working conditions for women in typical female occupations. Organisational intervention that aimed to reduce and redistribute the physical and psychosocial workload was shown to improve the working conditions for the women exposed to great strain.

Being physically active is associated with self-rated good health in low-educated, gainfully employed women aged 45 to 64. However, recommended sufficient aerobic capacity does not need to have an association with self-rated good health for the same group.

Sammanfattning (Summary in Swedish)

Dahlberg R. (2005). *Hälsa och arbetsvillkor bland lågutbildade kvinnor*. Arbete och Hälsa 2005:9.

I denna avhandling har lågutbildade kvinnors villkor på arbetet och i hemmet undersökts. Det övergripande syftet var att få en djupare förståelse för lågutbildade kvinnors villkor på arbetet och i hemmet och hur dessa villkor påverkar deras hälsa. Metoder som använts har varit frågeformulär, intervjuer, observationer och direkta mätningar.

Den empiriska basen har varit kvinnor och män som arbetar i Östergötland. Fyra studier har genomförts. Varje studie har sin egen ansats beträffande metoder och deltagare.

Den första studien var en befolkningsbaserad tvärsnittsstudie som inkluderade 3,831 yrkesverksamma personer. Syftet var att studera skillnader i hälsa och exponering mellan kvinnor och män med samma utbildningslängd. I den andra studien jämfördes kvinnor och män som utförde samma arbetsuppgifter. Deras arbetsteknik observerades och prevalens av besvär i rörelseorganen jämfördes. Studien genomfördes på en metallindustri och inkluderade 55 arbetare. Den tredje studien var en interventionsstudie vars syfte dels var att undersöka de fysiska och psykosociala arbetsvillkoren hos en grupp kvinnliga matdistributörer och dels ge förslag till förbättringsåtgärder. Den fjärde och sista studien hade en experimentell ansats. Via hypotesgenererade intervjuer som kombinerades med enkätdata och mätningar av konditionsvärden var syftet att leta efter faktorer som kan ha samband med god självskattad hälsa utanför det betalda arbetet hos lågutbildade yrkesverksamma kvinnor i åldern 45-65 år.

Resultaten av studierna kan sammanfattas enligt följande:

Kvinnor med samma utbildningslängd som män är olika exponerade både i betalt och obetalt arbete på grund av den segregerade arbetsmarknaden och den ojämlika fördelningen av det obetalda arbetet i hemmet. Lågutbildade kvinnor rapporterade högre prevalens av muskuloskeletala symptom från de flesta kroppsdelar jämfört med lågutbildade män. Jämfört med högutbildade kvinnor, rapporterade lågutbildade kvinnor sämre hälsa i nästan alla studerade indikatorer på hälsa.

Även när kvinnor utförde samma arbetsuppgifter som män rapporterade fler kvinnor än män en högre prevalens av muskuloskeletala symptom, speciellt från skuldror. Förutom skillnader i arbetsteknik, som delvis kan förklaras med arbetsplatsens utformning av arbetshöjder och verktyg, visade studien även på skillnader av spenderad tid i hushålls- och underhållsarbete i hemmet. Kvinnorna spenderade betydligt mer tid än männen i detta obetalda arbete.

Ergonomiska mätmetoder av de fysiska arbetsvillkoren samt strukturerade intervjuer för att fånga psykosociala aspekter av arbetsvillkoren visade sig vara

användbara metoder för att synliggöra svåra arbetsförhållanden för kvinnor i typiska kvinnoarbeten. Organisatoriska interventioner i syfte att reducera den fysiska och psykosociala arbetsbelastningen visades kunna förbättra arbetsvillkoren för den undersökta gruppen kvinnor.

Att vara fysiskt aktiv har samband med självskattad god hälsa hos lågutbildade yrkesverksamma kvinnor i åldern 45 till 65 år. Emellertid, rekommenderade konditionsvärden behöver inte ha samband med god självskattad hälsa för samma grupp kvinnor.

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